## REMARKS

Responsive to the non-final Office Action mailed November 6, 2009, which reopened prosecution, Applicants respectfully request (i) entry of these amendments and remarks, and (ii) reconsideration and allowance of the application.

### Status of the claims

The Office Action mailed Nov 6, 2009 reports examination of pending claims 1, 4, and 6-26. Claims 2, 3, and 5 are canceled. (Note, the Office Action Summary incorrectly lists claims 2, 3, and 5 as pending but withdrawn.)

Claims 1, 4, 6-11, 14-16, 18, 20, and 21 stand rejected under 35 U.S.C. § 103(a) as allegedly unpatentable over Sugiura et al., U.S. Pat. No. 6,359,587 (hereinafter "Sugiura") in view of Bing et al., U.S. Pub. No. 2004/0023649 (hereinafter "Bing").

Claims 12, 13, 17, 19, 20, and 22-25 stand rejected under 35 U.S.C. § 103(a) as allegedly unpatentable over Sugiura in view of Bing in further view of Lee et al., U.S. Pub. No. 2004/0039817 (hereinafter "Lee").

### Claim amendments

<u>Claims set 1, 4, and 6-89</u>: Not amended herein.

<u>Claims set 9-15, 17, 21, and 23</u>:

Claim 9 is amended to recite the titular operation of handing off the selected mobile device from one communication access point to another communication access point based on the predefined map and the calculated current location in the *body* of the claim, and is further amended for conciseness and clarity. Dependent claims 10, 11, 13, and 21 are amended for conciseness and clarity. Dependent claims 12 and 23 are canceled herein.

<u>Claims set 18 and 16, 19, 20, and 22</u>: Canceled herein.

<u>Claims set 24-26</u>:

Claim 24 is amended to focus on the titular application of (in the context of providing wireless communication service to the mobile wireless unit via a selected communication access point) handing off the mobile wireless unit from one selected communication access point to another selected communication access point based on the calculated location and the map. Claim 26 is amended to correct a potential antecedent basis issue.

<u>New claim set 27-30</u>: New claims set focusing on the titular application.

In these amendments, the added explicit recitation of communication aspects such as "providing wireless communication service to the mobile wireless unit via a selected communication access point" is clarifying in nature, and finds support in the original specification at least at page 3 lines 27-31, page 4 lines 13-17 and 21-25, page 6 lines 23-24, and page 7 lines 8-9.

**The present application**

When a mobile device moves from one area to another, a handoff is performed to assign a new access point. As described in the background of the present application: "A typical approach for a mobile device handoff is to scan all radio frequencies within the WLAN operational space to determine a relative strength of the mobile device signal." Present application page 2 lines 5-7 (background section). The handoff is then to the access point providing the strongest signal strength.

Since the point of the communication access point is to provide wireless communication with the mobile device, selecting the access point with the strongest signal strength makes intuitive sense.

The present application, however, recognizes some disadvantages with this conventional "strongest signal" handoff approach, including a high usage of system resources and slow down of communications throughput. Present application page 2 lines 5-13. An additional disadvantage alluded to in the present application is that if the mobile device passes only briefly through the area for which a certain access point (e.g., APA) provides the strongest signal, this can result in an inefficient multiplicity

of handoff events as the mobile device is briefly handed off to APA almost immediately followed by another handoff event. *See Id.* page 7 lines 20-23.

Recognizing these disadvantages, the present application discloses *location-based handoff* approaches, in which the location of the mobile device is tracked respective to a map of the access points and relative signal strengths of signals from the access points at predefined locations in the defined space. The handoff can be optimized based on the tracked location and the map. In this way, fewer access points can be probed since the tracked location and map identify the relevant closest access points, and only those need be probed. Further, the velocity can be determined from the tracking and a future position of the mobile device determined, which enables more seamless handoff. *See Id.* at page 6 lines 10-20. The potential for inefficient multiplicity of handoff events due to passing briefly through an access point area is reduced since it can be determined from the predicted position and the map when such a brief passage may occur. *Id.* at page 7 lines 18-24.

**The applied references**

The results of searching by the Office confirms the conventionality of the "strongest signal" handoff approach in the context of IEEE 802.11 wireless local area network (WLAN) systems:

> [W]ith wireless networks conforming to the IEEE 802.11 standard, APs, either periodically or upon request, send a beacon or a response frame that carries information such as network loading. Stations receiving these frames measure the received signal strength indicator (RSSI). The RSSI value represents the signal strength of the beacon or the response frame received by the station. Although the IEEE 802.11 specification provides beacon transmission that allows stations to discover the existence of APs in the network and provides the basic frame types to support association service between the station and AP, it does not actually set the AP selection algorithm. Using the RSSI value, conventional algorithms select the AP with the strongest signal.
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> Lee et al., U.S. Pub. No. 2004/0039817 A1 at ¶[0005] lines 6-19.

The point of alleged novelty for Lee is to augment the "strongest signal" handoff approach by an additional channel utilization indicator. *See, e.g.* Lee ¶[0009].

As already argued in this case by Applicants (*see, e.g.* Appeal Brief filed Sept. 22, 2009), Lee does not disclose or fairly suggest tracking the location of the mobile device, much less performing location-based handoff.

Sugiura relates to tracking of mobile stations based on signal strengths respective to a plurality of base stations. The alleged novelty of Sugiura is the use of a neural network and measurements at certain predefined points (e.g., charging stations, as shown in Sugiura Fig. 4) to construct a correlation between the reception radio strength levels and the position of the mobile station.

Sugiura is not related to handoff of a mobile device, much less location-based handoff of a mobile device.

Bing relates to aspects of time division multiplexing of upload/download phases for neighboring central stations, in which the upload and download phases of the neighboring stations do not overlap. This apparently is intended to reduce crosstalk. Bing does not relate to either tracking or handoff.

**The claim present patentable subject matter and should be allowed**

**Claim 1** recites, among other elements, wherein the tracking means tracks the movement of the selected mobile unit by periodically scanning the frequencies of the assigned access points adjacent the calculated location *and predicts future locations of the selected mobile unit*; wherein the assigning means assigns the nearby access points *based on the predicted location* of the selected mobile unit and the map.

Claim 1 stands rejected based on a proposed combination of Sugiura and Bing. Sugiura col. 14 lines 52-67 and col. 28 lines 58-67 are cited as allegedly disclosing the above-quoted limitations of claim 1. Applicants respectfully traverse.

The first cited section reads as follows:

> For the position detection of the mobile station, the operation of the system comprises two modes: a learning mode and an estimation mode. In the learning mode, the position coordinates corresponding to a plurality of predetermined measuring points are inputted through the position input section 114 of the control station 111 and stored in the position learning processing section 115. At this time, numbers indicative of the order of the measurements are assigned to the measuring points, and the coordinate

> system representative of the positions of the measuring points is singly determined in areas where the position detection is made. When the information on the measuring points are conveyed through some means to the mobile station 101 side, if the measuring points are indicated with points on a map, the mobile station 101 is transferred to the indicated points in the order of measurements, i.e., in the order of the
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> Sugiura col. 14 lines 52-67.

This is alleged to disclose "wherein the assigning means assigns the nearby access points *based on the predicted location* of the selected mobile unit and the map."

What is disclosed here is merely the learning and inference (i.e., estimation) modes of the neural network. A neural network must be trained using input data for which the desired neural network output is predetermined. The quoted paragraph is specifically describing the learning phase. Once the neural network is trained, it can be used to estimate (i.e., infer) the location based on new inputs. There is no *predicted location* involved – the inference is of the *current* location at the time of the measurement. Moreover, the only assignment of anything is assignment of an order of the measurements used in the training.

The second cited section reads as follows:

> Moreover, with the position detection method in which the mobile station periodically reports the measurement result of the reception radio strength levels to the control station at a constant time interval, it is possible to construct a system which detects the position of the mobile station at a regular interval and manages the position thereof. In addition, according to the position detection method where the reception radio strength is converted into a theoretical distance for the learning, not only the learning accuracy in the neural network can heighten but also the position estimation accuracy can improve.
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> Sugiura col. 28 line 58 – col. 29 line 1.

This is alleged to disclose "wherein the tracking means tracks the movement of the selected mobile unit by periodically scanning the frequencies of the assigned access points adjacent the calculated location *and predicts future locations of the selected mobile unit*." Applicants find no mention of predicting a future location here. The position estimation is for the *current* position at the time of the measurement. This is merely describing the inference or estimation phase of the neural network.

Bing cannot remedy these deficiencies of Sugiura, because Bing is not even related to tracking a *current* location, much less to predicting future locations.

**Claim 9** recites tracking movement of a selected mobile device within a defined space using wireless access points, each access point having a dedicated frequency different from the dedicated frequency of nearby access points, the tracking including measuring actual signal strengths at the dedicated frequencies of a current plurality of the access points neighboring the last calculated location of the selected mobile device, and calculating a current location of the mobile device by comparing the measured actual signal strengths with a predefined map of relative signal strengths at predefined locations in the defined space; based on the predefined map and the calculated current location, identifying from the predefined map an updated current plurality of the access points neighboring the current calculated location with the strongest signals at the current calculated location and assigning the updated current plurality of the access points with strongest signals to the selected mobile device; performing wireless communication with the selected mobile device using a communication access point selected from the access points; and handing off the selected mobile device from one communication access point to another communication access point based on the predefined map and the calculated current location.

Claim 9 recites location-based handoff, i.e. *handing off* the selected mobile device from one communication access point to another communication access point *based on the predefined map and the calculated current location.* Of the applied references, only Lee relates to handoff -- but Lee teaches the conventional "strongest signal" handoff approach augmented by an additional channel utilization indicator. *See, e.g.* Lee ¶[0009]. There is no suggestion in Lee of handing off based on [a] predefined map and [a] calculated current location.

Sugiura cannot remedy these deficiencies of Lee. Sugiura discloses location tracking of a mobile station, but does not disclose or fairly suggest using location tracking as a basis for handing off a mobile device from one communication access point to another communication access point.

There is no motivation in the references or in the state of the art at the time of invention to modify the conventional "strongest signal" handoff approach of

Lee to incorporate a location tracking basis. Lee itself suggests that the intuitive "strongest signal" handoff approach has disadvantages in terms of channel utilization:

> However, selection algorithms based only on RSSI values do not always select the AP that results in the best communication and/or throughput. For example, a wireless station has received information (e.g., contained in beacon or response frames) from three potential access points, $AP_1$, $AP_2$, and $AP_3$, with which to associate. If $AP_2$ has the highest RSSI value, $AP_2$ is selected, and a connection is established. However, $AP_2$ may also be maintaining connection with a large number of other wireless stations, resulting in a high network loading for $AP_2$. So, even though $AP_2$ has the strongest received signal, the wireless station may experience very low performance, which could initiate another scan by the wireless station for a better connection. Thus, in this case, the station will find itself consuming most of the time in searching for APs instead of transmitting useful data.
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> Lee ¶[0007].

However, there is no suggestion of using handoff based on location tracking to overcome the problem identified in Lee of uneven channel utilization. Rather, to the contrary Lee expressly discloses a different solution that is not based on tracking location, namely the solution of augmenting the "strongest signal" approach by a channel utilization indicator. Lee ¶[0009].

Bing cannot remedy these deficiencies of Sugiura and Lee, because Bing does not relate to either location tracking or mobile device handoff.

**Claim 13** depends from claim 9, and recites estimating a speed and a direction of movement of the selected mobile device based on the tracking including at least the calculated current location and the last calculated location; and predicting a future location of the selected mobile device from the estimated speed and direction; wherein the handing off is based on the predicted future location and the map.

As argued previously respective to claim 1, the combination of Sugiura and Bing does not disclose or fairly suggest predicting a future location (much less *handing off* based on a predicted location and a map). Lee cannot remedy this deficiency because Lee does not even hand off based on a calculated *current* location, much less based on a predicted future location.

**Claim 24** recites a communication system comprising: a mobile wireless unit located within a defined space of a wireless local area network; a

plurality of access points disposed at known locations in the defined space, each access point operating at a dedicated frequency; a computer processor for tracking movement of the mobile wireless unit and reassigning frequencies of closest access points to the mobile wireless unit, the computer processor being programmed to perform the steps of: measuring actual signal strengths at the dedicated frequencies of an identified plurality of nearby access points between the mobile wireless unit and the identified nearby access points, calculating a location of the mobile wireless unit by comparing the actual signal strengths with a map of relative signal strengths at predefined locations in the defined space; updating the identification of nearby access points with strongest signals to the mobile wireless unit based on the calculated location and the map; providing wireless communication service to the mobile wireless unit via a selected communication access point; and handing off the mobile wireless unit from one selected communication access point to another selected communication access point based on the calculated location and the map.

Claim 24 recites location-based handoff, i.e. *handing off* the mobile wireless unit from one selected communication access point to another selected communication access point *based on the calculated location and the map*. None of Sugiura, Bing, Lee, or their combination disclose or fairly suggest this recitation.

**Claim 27** recites a method comprising (among other elements) handing off the mobile device from one selected communication access point to another selected communication access point based on the predefined map and the determined location of the mobile device. Again, none of Sugiura, Bing, Lee, or their combination disclose or fairly suggest this recitation.

In view of the foregoing, Applicants respectfully submit that claims 1, 4, 6-11, 13-15, 17, 21, and 24-30 present patentable subject matter, meet all statutory requirements, and should be allowed. Accordingly, Applicants earnestly request allowance of claims 1, 4, 6-11, 13-15, 17, 21, and 24-30.

## CONCLUSION

In view of the foregoing, Applicants earnestly request reconsideration and allowance of claims 1, 4, 6-11, 13-15, 17, 21, and 24-30.

In the event the Examiner considers personal contact advantageous to the disposition of this case, the Examiner is requested to telephone Thomas Kocovsky at 216.363.9000.

Respectfully submitted,

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